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ABSTRACT

As part of a research program to identify training methods which optimize skill acquisition and retention, three studies were conducted to assess the effects of type of training, amount of practice, and guided discussion in cognitive learning strategies training programs. Undergraduate students enrolled in educational psychology courses were trained in the use of imagery, elaboration, and grouping strategies, and then tested on free recall, reading comprehension and paired associate tasks. Training that emphasized the process of creating learning strategies as well as the product (the strategy itself) demonstrated equivalent or superior results when compared to a program that emphasized only the product. Training that included practice using the strategies was found to be more effective than training without such practice. However, when practice included guided discussion of the strategies generated, performance on posttest tasks was adversely affected, possibly due to trainees modeling the products presented in the discussion rather than the processes. Statistical data and instructional materials are included. (Author/AEF)

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Technical Report 463

# THE EFFECTS OF SELECTED INSTRUCTIONAL VARIABLES ON THE ACQUISITION OF COGNITIVE LEARNING STRATEGIES

Claire E. Weinstein, Vicki L. Underwood, Magdalena M. Rood,
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Three studies were conducted to assess the effects of type of training, amount of practice, and guided discussion in cognitive learning strategies training programs. Undergraduate students were trained to use imagery, elaboration, and grouping strategies. Training that emphasized the process of creating learning strategies as well as the product (the strategy itself) demonstrated equivalent or superior results when compared to a program that emphasized only the process, and both were found to be superior to a program that

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emphasized only the product. Training that included practice using the strategies was found to be more effectve than training without such practice. However, when practice included guided discussion of the strategies generated, performance on posttest tasks was adversely affected, possibly due to trainees modeling the products presented in the discussion rather than the processes.

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FOREWORD

The Personnel and Training Research Laboratory of the Army Research Institute for the Behavioral and Social Sciences (ARI) conducts research to support training methods to optimize skill acquisition and retention. A variety of research is being conducted on the effects of various learning strategies on skill acquisition and retention. ARI, in cooperation with the Defense Advanced Research Projects Agency (DARPA), is especially interested in training that improves the trainee's ability to learn.

This report is one of a series on the development of the Cognitive Learning Strategies Training Program. This report discusses the effects of selected instructional variables on the acquisition of Cognitive Learning Strategies. Research was conducted at the University of Texas at Austin, under contract DAHC19-76-C-0026, monitored by Joseph S. Ward of ARI under Army Project 2Q161102B74F, and funded by DARPA.

JOSEPH ZEIDNER
Technical Director

THE EFFECTS OF SELECTED INSTRUCTIONAL VARIABLES ON THE ACQUISITION OF COGNITIVE LEARNING STRATEGIES

BRIEF

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Requirement:

To investigate the effects of several instructional components in cognitive learning strategies training programs.

Procedure:

Three studies assessed the effectiveness of different types of training, amount of practice, and guided discussion in cognitive learning strategies training programs. The three strategies presented were imagery, elaboration, and grouping. The training emphasized either the product (the strategies themselves), the process of creating the strategies, or a combination of process and product. Product-oriented training included brief explanations of the strategies, examples of their use, opportunities to apply the strategies to a sample passage, and, in one study, practice using them with additional reading passages. Process-oriented training included a presentation of the characteristics of effective strategies and practice exercises to show how these characteristics might be incorporated into strategies. The programs with dual emphases included all of the components stated above. Discussion of student-generated examples with feedback from the experimenter was included in all programs in the first two studies. It was investigated as a variable in the third study by comparing a group which received this type of discussion as a part of their practice to a group that did not. A control group was included in each study. Performance measures included reading comprehension, free recall, and paired-associate tasks.

Findings:

The results support the hypotheses that students can be trained to use cognitive learning strategies and that some forms of training are more beneficial than others. Training that emphasizes the process of creating learning strategies is as effective or more effective than programs that emphasize only the product, or a combination of product and process. Training that includes practice using the strategies is more effective than training without practice. However, when practice includes guided discussion of the strategies generated, performance on tasks similar to those used for practice may be adversely affected, possibly due to trainees modeling the products presented in the discussion rather than the processes.

Utilization of Findings:

The results of these studies can be used to further develop programs to train learners to use cognitive learning strategies. The results suggest that training in the processes used to create the strategies and practice applying the strategies are important components of such a program. Discussion of learner-generated and experimenter/trainer-provided examples of strategies may inhibit the production of effective strategies for tasks similar to those discussed. Further research will be needed to determine the extent of this effect.

THE EFFECTS OF SELECTED INSTRUCTIONAL VARIABLES ON THE ACQUISITION OF COGNITIVE LEARNING STRATEGIES

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# THE EFFECTS OF SELECTED INSTRUCTIONAL VARIABLES ON THE ACQUISITION OF COGNITIVE LEARNING STRATEGIES

## Introduction

This research was conducted as part of the Cognitive Learning Strategies Project at the University of Texas at Austin. The purpose of this series of studies was to examine the effects of a number of instructional variables, such as type of training, amount of practice, and use of guided discussion on the acquisition of three types of cognitive learning strategies. These variables were investigated within the context of training programs developed from the results of our previous research. Several factors were found to be important considerations for inclusion in such programs. For example, training which includes practice and feedback was found to be more effective than simple instruction alone (Weinstein, Wicker, Cubberly, Roney, and Underwood, 1980), and the use of difficult reading materials early in the training process was found to have a debilitating effect on performance, suggesting that materials should progress from simple to difficult (Weinstein, Washington, Wicker, Duty, and Underwood, 1980).

The three strategy types selected for inclusion in these training programs were imagery, meaningful elaboration, and grouping. The cluster of strategies involving imagery calls for the learner to form a mental picture of the person, events or information to be learned. Elaboration involves enhancing the meaningfulness of to-be-learned material by relating it to the learner's current cognitive structure. For example, as a student or trainee reads through a passage he or she might ask and answer such questions as, "What is the purpose of this material?" or "How does this relate to my experience, beliefs, and attitudes?" or other

similar questions which are designed to involve the learner in actively relating to the new information. Grouping, as used in this research, is actually a combination of strategies whereby the learner first clusters information according to meaningful relationships by putting similar materials together and then uses imagery or verbal elaboration to learn the elements of each cluster.

## Experiment I: A Comparison of Three Cognitive Learning Strategies Training Programs

The first study in this series examined the effects of three training programs designed to enhance the learning strategies of college students. The three programs included: a) one used previously (Weinstein, Washington, et al., 1980), called the traditional program; b) one that concentrated on teaching the basic, or underlying, processes used in formulating cognitive learning strategies, and c) a combination of the two.

The traditional program was designed to train students in the use of the three cognitive learning strategies by providing a brief explanation of each strategy followed by several written examples of how the strategy could be used to learn the information in a sample passage. Students were then asked to generate their own examples of appropriate learning strategies. The basic processes program trained students in the use of the same three cognitive strategies but the instructional emphasis was on the processes used to create learning strategies, rather than on the final product. After receiving instructions concerning the characteristics of effective cognitive learning strategies, students were asked to generate their own strategies using the guidelines presented. The combined program included both the basic processes and traditional training. After students were introduced to the basic processes involved in the formulation of effective strategies and given an opportunity to generate their own examples, they

received the traditional program instructions and training exercises.

It was hypothesized that the three training groups would demonstrate superior performance over a control group that did not receive training, but the three programs would affect learning performance differentially. Because of its dual emphasis on process and product, the combined program was expected to be more beneficial than either traditional or basic processes separately.

## Method

Participants. A total of 104 students enrolled in an undergraduate educational psychology course at The University of Texas at Austin participated in this research as part of their course requirement. Four students had to be dropped from the study because they failed to attend both the training and testing sessions.

Materials. In addition to instructions, which were read aloud by the experimenter, each student in the traditional and combined instructions groups received a packet containing a sample passage and descriptions of the three learning strategies (imagery, meaningful elaboration, and grouping) with examples of how they could be used to learn the information contained in the sample passage. This passage discussed an alternative framework for public school systems (Kneller, 1971). (A copy of the instructions for the traditional instructions group and the basic processes group can be found in Appendices A and B, respectively. A copy of the student packet can be found in Appendix C.)

The practice materials included two reading passages from the Science Research Associates (SRA) Rate Builder Lab IVa (1959) materials. The first practice passage, a ninth-grade-level reading, described the physical requirements for space travel. The second practice passage, a fourteenth-grade-level reading, discussed the concept of intelligence in society.

The students in the combined instructions group used the same materials as the basic processes and the traditional groups. There were no training materials for the members of the control group.

The testing materials included a free recall list of 20 words, a paired-associate list of 30 word pairs, and three reading passages. The two word lists were constructed using the Paivio, Yuille, and Madigan (1968) norms. The words on the free recall list were of average concreteness (ratings in the range of 3.17 to 5.19 on a 7-point scale) and average meaningfulness (ratings in the range 4.89 to 6.63, representing the average number of associations given by an individual in a 1-minute period). The words on the paired-associate list were, either high concrete (ratings in the range of 6.69 to 7.00) or low concrete (ratings in the range of 1.18 to 3.54) and of average meaningfulness (ratings in the range of 4.17 to 7.12). These words were then randomly paired with the restriction that half of the pairs were composed of low-concrete words and half were composed of high-concrete words.

The three reading passages used for testing were selected from the SRA (1959) materials. The first passage, a ninth-grade-level reading, described the adult lives of former child prodigies. The second passage was at the tenth-grade reading level and described a sea fight between a whale and a killer fish. The third passage, an eleventh-grade-level reading, explained the structural mechanics of snoring. A short answer test consisting of 10 items was developed for each passage.

Design and Procedure. The students were randomly assigned to one of four groups: the traditional instructions group (N = 27), the basic processes group (N = 25), the combined instruction group (N = 25) or the control group (N = 27). Students met in groups of six to ten for two sessions. The first session was 2 hours long (training session) and the

second session was 1 hour long (testing session). The first session for the three experimental groups included training and, for the traditional and combined groups, practice using the strategies. This session concluded with the immediate posttest using the ninth-grade-level reading comprehension task. The control group received no training or practice but did take the immediate posttest. During the second session, the remaining posttests were administered to the students in all four groups.

Traditional Instructions Training

The traditional program began with a brief introduction to the purpose of the research. The instructional packets were distributed to the students, and they were told that they had 8 minutes to complete the section on imagery. The students were also told that the experimenter would be available to answer questions. After the students completed the section on imagery, the students were asked for examples of strategies they generated. This procedure was then repeated for the sections in the student packet discussing grouping and meaningful elaboration (see Appendices A and C).

After all three sections in the student packet were completed, the participants were given an opportunity to practice using these skills to learn the information contained in the two SRA (1959) passages designated as practice readings. The students were given 7 minutes to study each passage and write down examples of learning strategies they would use. These materials were then collected and the immediate posttest was administered.

Basic Processes Training

Whereas the traditional program focused on <u>providing examples</u> of well-formulated learning strategies, the basic processes training concentrated on <u>describing the characteristics</u> of effective learning strategies (see

Appendix B). In the traditional group, the students were to deduce the underlying heuristics from the examples provided, whereas in the basic processes group, the students were to adapt the heuristic guidelines to specific learning needs. After receiving a brief introduction to the purpose of the research, the students in the basic processes group listened to descriptions of the process of formulating each of the three types of strategies. This was followed by a list of the characteristics of effective imagery, elaboration, and grouping strategies.

After each type of strategy was discussed, the students completed a set of training exercises. For example, the section discussing imagery included three training exercises: creating images of two people on a picnic, a person fishing, and the house of one's dreams. Each exercise was followed by a discussion of how the characteristics could have been used to create a good image and a discussion of student-generated examples.

After completing the discussions of the three strategies, the experimenter concluded the training session by reviewing their characteristics. All materials were then collected and the immediate posttest was administered.

Combined Instructions Training

The training procedure for the combined instructions group incorporated the procedures used with both of the other experimental groups. Thus, this group was given the instructions and training exercises used with the basic processes group followed by the instructions, training exercises, and practice readings used in the traditional program. However, because the students in the combined instructions group studied the characteristics of effective strategies, a component which had not been included in the traditional program, the discussions of the training exercises were adapted to include comparing the student-generated strategies to a summary list of these characteristics. After completing the training included in both of

the other programs, all materials were collected and the immediate posttest was administered.

Control

The members of the control group did not receive any training or complete any of the training or practice exercises. They did, however, take the posttests. The immediate posttest occurred at the end of the first session for all four groups. The students were allowed 3 minutes to study the passage about child prodigies. They then had 5 minutes to answer a 10-item short-answer test.

Additional posttests were administered to the students in all four groups during the second session. Each participant was tested on free recall, paired-associate, and two reading comprehension tasks, in that order. For the free recall posttest 20 words were presented, one at a time, on a Da-Lite screen. Each word was presented for 8 seconds using a Kodak slide projector with an automatic timing device. After all words were presented, the students were given 2 minutes to write down as many of the words as they could remember without regard to the order of presentation.

The next posttest, a paired-associate task, was administered using the study-test method. Thirty word pairs were presented using an 8-second exposure rate for both study and test segments.

The last two posttests were both reading comprehension tasks. The students were given 5 minutes to study each passage and 4 minutes to complete the 10-item short-answer test.

Results and Discussion

One-way analyses of variance were used to analyze the data from each of the five posttest tasks. For the analysis of the free recall data, the scores of two students in the traditional instructions group had to be eliminated due to a faulty slide projector. For the analysis of the

paired-associate data, the score of one student in the combined instructions group and the score of one student in the control group had to be eliminated because they failed to complete the task. The adjusted number of students in each of these groups, as well as the means and standard deviations for each of these tasks, can be found in Tables 1 and 2.

The analyses performed for the three reading comprehension tasks revealed no significant differences among the groups. The means and standard deviations for each of these tasks can be found in Table 1.

The analysis of the free recall test scores (see Table 3) revealed a significant difference among the group means ($F(3,96) = 4.27$, $p < .01$). A Newman-Keuls procedure was then used to determine the means among which significant differences existed. This analysis revealed that the performance of the combined instructions group surpassed that of the traditional instructions and control groups. It did not, however, differ from the basic processes group, which did not differ significantly from the traditional instructions and control groups. The means and standard deviations for the free recall task can be found in Table 2.

The analysis of the paired-associate test scores (see Table 4) also revealed a significant difference among the group means ($F(3,96) = 5.42$, $p < .01$). A Newman-Keuls procedure revealed that the performance of the combined instructions group again surpassed that of the traditional instructions and control groups, which did not significantly differ from each other. In addition, the performance of the basic processes group was significantly better than that of the control group but did not significantly differ from the performance of either the traditional or the combined instructions groups. The means and standard deviations for the paired-associate task can be found in Table 2.

These results only partially support the hypotheses that students can

TABLE 1

Means and Standard Deviations on the Three Reading Tasks in Experiment 1

| Dependent Measure | Group | N | Mean | S.D. |
|---|---|---|---|---|
| Reading 1 | Traditional instructions | 26 | 6.28 | 1.52 |
| (Child Prodigies) | Basic processes | 25 | 6.55 | 1.04 |
| (maximum score = 10) | Combined instructions | 24 | 6.70 | 1.43 |
| | Control | 27 | 6.80 | 1.75 |
| Reading 2 | Traditional instructions | 26 | 7.38 | 1.08 |
| (Sporting) | Basic processes | 25 | 8.06 | 1.08 |
| (maximum score = 10) | Combined instructions | 24 | 7.46 | 1.21 |
| | Control | 27 | 7.70 | 1.91 |
| Reading 3 | Traditional instructions | 26 | 11.37 | 1.55 |
| (Sea Fight) | Basic processes | 25 | 11.20 | 1.32 |
| (maximum score = 13) | Combined instructions | 24 | 11.58 | .78 |
| | Control | 27 | 11.56 | 1.01 |

TABLE 2

Means and Standard Deviations on the Free Recall and Paired-Associate Tasks in Experiment I

| Dependent Measure | Group | N | Mean | S.D. |
|---|---|---|---|---|
| Free Recall | Traditional instructions | 24 | 8.75 | 2.44 |
| | Basic processes | 25 | 10.08 | 2.29 |
| | Combined instructions | 24 | 10.92 | 3.03 |
| | Control | 27 | 9.00 | 1.75 |
| Paired-Associate Task | Traditional instructions | 26 | 13.04 | 6.62 |
| | Basic instructions | 25 | 16.04 | 4.70 |
| | Combined instructions | 23 | 17.78 | 5.63 |
| | Control | 26 | 12.15 | 5.10 |

TABLE 3

Source Table for Analysis of Variance
on the Free Recall Scores in Experiment I

| Source | SS | df | MS | F | p |
|---|---|---|---|---|---|
| Between Groups | 73.94 | 3 | 24.65 | 4.27 | <.01 |
| Within Groups | 554.17 | 96 | 5.77 | | |
| Total | 628.11 | 99 | | | |

TABLE 4

Source Table for Analysis of Variance on the
Paired-Associate Task in Experiment I

| Source | SS | df | MS | F | p |
|---|---|---|---|---|---|
| Between Groups | 503.53 | 3 | 167.84 | 5.42 | <.01 |
| Within Groups | 2973.22 | 96 | 30.97 | | |
| Total | 3476.75 | 99 | | | |

be trained to modify their information processing capabilities, and that some training procedures are more effective than others. The traditional instructions appear to be the least effective; the performance of the group receiving them was not significantly different from that of the control group. The basic processes training resulted in performance that was not significantly better than that of the traditional instructions group, but which did exceed the control group's performance on the paired-associate task. The superior performance of the combined instructions group on both the free recall and paired-associate tasks suggests that this multi-instructional approach, which includes both the basic processes and traditional instructions, is more effective than the traditional instructions alone.

The lack of differences between the combined instructions and basic processes groups may reflect the relative importance of the basic processes component in the combined instructions training. However, the basic processes training alone produces results that are not significantly different from the traditional training. Thus, it appears that neither the provision of examples nor the underlying processes alone is sufficient to significantly enhance performance. However, when these two methods are combined, some significant performance increases do occur.

The next study investigated further the effectiveness of a multi-instructional approach as compared to the basic processes training program. It also investigated the effects of using longer and more complex reading comprehension tasks for posttesting.

## Experiment II: Cognitive Learning Strategies: Basic Processes Versus Integrated Instructions

### Method

Participants. A total of 84 students enrolled in an introductory educational psychology course at the University of Texas at Austin par-

ticipated in this research as part of their course requirement. Seventeen students were dropped from the study because they failed to attend all three sessions.

Materials. The instructions for the basic processes group were the same as those used in the previous study (see Appendix B). However, a procedural change was made to present the grouping strategy after the other two strategies were discussed. This change was made because grouping incorporates elements of both the imagery and meaningful elaboration strategies.

The materials for the integrated instructions group consisted of both the basic processes instructions (see Appendix B) and the student packet used in the first study (see Appendix C). For this study, however, the packet was separated into three sections, one for each strategy, such that one section could be distributed at a time.

The materials used by the control group in the first session consisted of three reading passages: the Kneller (1971) passage (also included in the student packet for the integrated instructions group), and two ninth-grade-level reading passages taken from the SRA (1959) materials. The SRA readings described the physical requirements for space travel and the phenomenon of a tornado.

The testing materials included a free recall list of 20 words, a paired-associate list of 28 word pairs, three reading passages, and a test over the characteristics of the strategies. The two word lists were constructed using the Paivio, et al. (1968) norms. Half of the words on the free recall list were of average to high concreteness (ratings ranged from 5.75 to 6.96 on a 7-point scale), and half of the words were of low concreteness (ratings ranged from 1.73 to 3.88). The words on the paired-associate list had an average meaningfulness rating of 5.73, with a range from 4.56 to 7.00. These words were either low concrete (ratings ranged

from 0.00 to 3.00) or average to high concrete (ratings ranged from 5.00 to 7.00). The words were paired such that there were four groups of seven word pairs each: 1) average to high-concrete words paired with average to high-concrete words; 2) average to high-concrete words paired with low-concrete words; 3) low-concrete words paired with average to high-concrete words; and 4) low-concrete words paired with low-concrete words.

In order to assess the usefulness of longer reading passages for testing, the passages were selected with the restrictions that two of the three contain between 1,500 and 2,000 words and discuss fairly complex information. The first passage, approximately 1,700 words long, described the various actions upon the Earth's surface by a number of its gradational agents (Cable, Getchell, Kadesh, Poppy & Krull, 1968). The second was approximately 250 words long and described the visual properties of certain numbers (Tiegs & Clark, 1970). The third passage, approximately 1,700 words long, explained several extended kinship systems (Adamson, 1970). Two comprehension tests were constructed for the first two reading passages; for the third only one posttest was constructed.

A questionnaire designed to measure students' recall of the characteristics of each of the strategies presented during training was included in the testing materials.

Design and Procedure. Students were randomly assigned to one of three groups: basic processes (N = 17), integrated instructions (N = 25), or control (N = 25). Students met in groups of five to fifteen for three sessions. All students attended three sessions separated by 1-week intervals. The first session consisted of 2 hours of training for both of the experimental groups. The control group did not receive any training, but did study three reading passages. During the second and third sessions (which were each 1 hour long) all groups completed the posttests. The strategy char-

acteristics questionnaire was also administered to the students in the training groups during the second session.

Basic Processes Training

The basic processes training program concentrated on the characteristics of effective learning strategies (see Appendix B). The training procedures were essentially the same as those described in the first study. However, the grouping strategy was presented after the discussion of imagery and elaboration.

Integrated Instructions Training

The integrated instructions training program was a modification of the procedures used by the combined instructions group in the first study. In the integrated form, the basic processes instructions for each learning strategy were followed by the traditional training procedures for that strategy. For example, after listening to the discussions of the processes necessary to formulate an effective mental image and completing the three training exercises, students were presented with the section on imagery from the traditional program student packet (see Appendix C). This procedure was repeated for the elaboration strategy and again for the grouping strategy.

Control

The control group received no instructions in the use of cognitive learning strategies. They were simply asked to read three passages. Eight minutes were allotted for each passage.

The first series of posttests was administered to all three groups during the second session. The basic processes and the integrated instructions groups were first tested on the characteristics of the three cognitive learning strategies. Four minutes were allotted for completion of this questionnaire. After the test papers were collected, these characteristics were briefly reviewed with the students. The students were then given 15

minutes to study the first passage about gradational agents. Upon collection of this passage, they were given 5 minutes to study the second passage about visual properties of certain numbers. This passage was collected, and then the free recall task was begun. Each word was presented for 8 seconds on a Da-Lite screen using a Kodak slide projector with an automatic timing device. After all the words were presented, the students were given 2 minutes to write down as many of the words as they could remember without regard to the order of presentation.

The last two posttests in this session were the comprehension tasks over the passages read earlier in the session. This delay was intended to assess the effectiveness of the students' strategies over a short time interval that included other activities in order to reduce the possibility of rote rehearsal. Students were given 10 minutes to complete the 6-item short-answer test over the contents of the passage about gradational agents. They were then given 5 minutes to complete the 6-item multiple-choice and short-answer test over the contents of the passage on visual properties of certain numbers. The students in the control group were administered all the posttests with the exception of the strategy characteristics questionnaire.

The second series of posttests was administered to all three groups during the third session of the study. The first two tests were delayed measures over the contents of the reading passages presented during the second session. The students were given 10 minutes to answer the 7-item short-answer test over the contents of the passage on gradational agents, and 5 minutes to answer the 10-item short-answer test over the contents of the passage on visual properties of certain numbers. Then the third posttest, a reading comprehension task using the kinship reading, was administered. The students were given 15 minutes to study this passage and 10 minutes to complete the 9-item short-answer comprehension test.

The last posttest, the paired-associate task, was administered using the study-test method. Twenty-eight word pairs were presented using an 8-second exposure rate for both study and test segments.

Results and Discussion

The reading comprehension test protocols from a random sample of six respondents from each group were independently graded by three raters. An inter-rater reliability coefficient was computed for each of the items on each of the tests. The coefficients were above .90 for all the items on three of the test instruments, and the coefficients for the other two instruments were above .75. A portion of one item on the gradational agents reading comprehension test and one item on the kinship reading comprehension test were deleted completely from subsequent analyses due to rater disagreement.

One-way analyses of variance were performed on the data from each of the eight posttests. The means and standard deviations for the posttest tasks administered during the second experimental session can be found in Table 5. The analyses performed for the characteristics test and the test over the gradational agents reading revealed no significant differences among the groups.

The analysis of the data from the free recall task (see Table 6) revealed a significant difference among the three groups ($F(2, 64) = 4.22$, $p < .05$). A Newman-Keuls procedure was used to determine the means among which significant differences existed. This analysis revealed that the performance of the integrated instructions group surpassed the performance of both the basic processes and control groups, which did not differ from each other.

The analysis of the data from the numbers reading comprehension test (see Table 7) also revealed a significant difference among the three groups

TABLE 5

Means and Standard Deviations for Posttest Tasks
Administered During the Second Session in Experiment II

| Dependent Measure | Group | N | Mean | S.D. |
|---|---|---|---|---|
| Characteristics test | Basic processes | 17 | 6.12 | 2.98 |
| | Integrated instructions | 25 | 6.04 | 1.79 |
| Free Recall | Basic processes | 17 | 9.29 | 3.06 |
| | Integrated instructions | 25 | 11.04 | 2.89 |
| | Control | 25 | 10.08 | 2.16 |
| Reading 1 (immediate test - Gradational Agents) | Basic processes | 17 | 8.41 | 3.79 |
| | Integrated instructions | 25 | 9.32 | 3.29 |
| (maximum score = 15) | Control | 25 | 8.84 | 2.54 |
| Reading 2 (immediate test - Numbers) | Basic processes | 17 | 5.53 | 2.33 |
| | Integrated instructions | 25 | 7.16 | 1.90 |
| (maximum score = 10) | Control | 25 | 6.50 | 1.88 |

TABLE 6

Source Table for Analysis of Variance on the Free Recall Task in Experiment II

| Source | SS | df | MS | F | p |
|---|---|---|---|---|---|
| Between Groups | 61.53 | 2 | 30.76 | 4.22 | <.05 |
| Within Groups | 467.13 | 64 | 7.30 | | |
| Total | 528.66 | 66 | | | |

TABLE 7

Source Table for the Analysis of Variance on the First Numbers Reading Comprehension Test in Experiment II

| Source | SS | df | MS | F | p |
|---|---|---|---|---|---|
| Between Groups | 26.90 | 2 | 13.45 | 3.34 | <.05 |
| Within Groups | 258.10 | 64 | 4.03 | | |
| Total | 285.00 | 66 | | | |

($F(2, 64) = 3.34$, $p < .05$). A Newman-Keuls procedure revealed that the performance of the integrated instructions group again surpassed that of the basic processes group. The performance of the control group was between that of the integrated instructions and basic processes groups, and not significantly different from either one.

The analyses performed for the four posttest tasks administered during the third session did not reveal any significant differences among the three groups. The means and standard deviations for these tasks can be found in Table 8.

The results of this study, as with the results of the first study, indicate partial support for the hypotheses that students can be trained to modify their information processing capabilities and that some forms of training are more effective than others. It appears that the integrated instructions training program is somewhat more beneficial for training college students to use cognitive learning strategies than the basic processes training program. The superior results obtained by the integrated instructions group during the second session of the study on the free recall test provide some support for this multi-instructional training approach. The data from the reading comprehension and paired-associate tasks are inconclusive. Although the integrated instructions group did perform significantly better than the basic processes group on the first comprehension test over the numbers reading, neither group's performance was significantly different from that of the control group. Results from the previous study, using short reading passages, had not demonstrated the effectiveness of the training for reading comprehension tasks. In this study, two longer and more complex reading passages were used to test the effectiveness of the training programs. However, no differences among the groups were found for these longer reading comprehension tasks either. Performance differences

TABLE 8

Means and Standard Deviations for the Posttest Tasks Administered During the Third Session in Experiment II

| Dependent Measure | Group | N | Mean | S.D. |
|---|---|---|---|---|
| Reading 1 (delayed test - Gradational Agents) (maximum score = 14) | Basic processes | 17 | 5.44 | 2.93 |
| | Integrated instructions | 25 | 4.88 | 2.24 |
| | Control | 25 | 5.66 | 2.73 |
| Reading 2 (delayed test - Numbers) (maximum score = 10) | Basic processes | 17 | 4.29 | 2.05 |
| | Integrated instructions | 25 | 5.24 | 1.71 |
| | Control | 25 | 4.92 | 1.89 |
| Reading 3 (Kinship) (maximum score = 14) | Basic processes | 17 | 7.76 | 2.59 |
| | Integrated instructions | 25 | 8.36 | 3.50 |
| | Control | 25 | 7.79 | 2.59 |
| Paired-Associate Task | Basic processes | 17 | 7.82 | 3.23 |
| | Integrated instructions | 25 | 8.92 | 5.24 |
| | Control | 25 | 6.92 | 5.16 |

were found in all but one instance on the free recall and paired-associate tasks in these two studies as well as on the numbers reading comprehension test in the second study. The content of this reading passage was considerably different from the other passages used in these two studies. It consisted of several rules for defining physical properties of numbers and examples of the application of these rules. The other readings were more narrative. Thus, it may be that the absence of differences on the reading tasks is not related to the length or complexity of the readings, but rather to some aspect of the training which limits its usefulness for improving reading comprehension but generally not for paired-associate and free recall tasks.

An analysis of the four training programs included in the two previous studies was conducted to assist in identifying the source of this problem. The programs included the following major components:

1. Student packets - explanations of the strategies, examples of their use, and opportunities to apply them to a sample passage (used with the traditional, combined, and integrated groups)

2. Basic processes - characteristics of effective strategies and practice exercises (used with the basic processes, combined, and integrated groups)

3. Practice using the strategies with additional reading passages (used with the traditional and combined groups)

4. Discussion of student-generated examples of strategies and experimenter's feedback (all four training programs)

The traditional program was shown to be the least effective in the first study. It was suggested that the similar performance of the combined instruction and basic processes groups might be explained by the basic processes component since the performance of these two groups did not differ significantly. However, the combined instructions training did include

practice using the strategies with additional reading passages (as well as the practice with the sample passage in the student packet after the basic processes component), whereas the basic processes did not. Thus, practice may also have been a factor accounting for the superior performance of the combined instructions group relative to the traditional and control groups.

In the second study, the basic processes and integrated instructions training differed only by the inclusion of the student packets for the latter group. Each section of the student packet was presented after the corresponding basic processes training. This procedure may be similar in its effect to the additional practice provided in the combined instruction program because the students in the integrated instructions group were provided with opportunities to practice generating strategies for the sample passage after receiving the basic processes training.

It would, therefore, appear that the basic processes and additional practice components are the most important portions of these cognitive learning strategies training programs. Since discussion of student-generated examples was included in all four programs, its effectiveness remains to be determined.

## Experiment III: Guided Versus Non-Guided Practice as a Variable in Cognitive Learning Strategies Training

The third study combined the basic processes training with additional practice using reading passages. It compared the effectiveness of this training (non-guided practice) with that of a similar training program that also included discussion of student-generated examples and the provision of examples by the experimenter (experimenter-guided practice). Paired-associate learning and reading comprehension were selected as the posttest tasks. However, the reading comprehension task was modified in light of the previous problems encountered with this type of task.

Paired-associate and free recall tasks are more structured than most

reading comprehension tasks, ie., the material to be remembered and to be tested is well defined by the nature of the task itself. Reading comprehension, on the other hand, requires the learner to select the important points to be remembered, and allows for a greater variety of testing procedures that the learner may also take into consideration while learning. For example, questions may either test recall or recognition memory or may be designed to tap different levels of the cognitive domain (Bloom, 1956). For this study, the reading comprehension task was modified to provide greater structure. Questions, similar to those on the posttest, were included for each of the practice readings to make the performance demands of these tasks more apparent and, therefore, to facilitate the students' use of cognitive learning strategies with reading passages.

Method

Participants. A total of 63 students enrolled in an introductory educational psychology course at The University of Texas at Austin participated in this research as part of their course requirement.

Materials. Students in the two training groups were provided with a practice packet which contained three readings selected from the SRA (1959) materials at the eleventh-grade level. The first reading described how British laws affected early American ideas of liberty; the second gave a brief biography of a Canadian aviation pioneer; and the third discussed the physical mechanics of snoring. Each reading was followed by two comprehension questions, each on a separate page of the packet. For each of these questions, the students were asked to include the correct response with a description of the strategy they used to learn the information needed to answer the questions. Students in the control group also received practice packets, but these contained only the readings and the questions; no strategy descriptions were requested.

The testing materials included the reading about the Earth's gradational agents (Cable, Getchell, Kadesh, Poppy & Crull, 1968) that was used in the previous study and a 6-item short-answer test over its content. A test booklet was constructed which presented each question on a separate page and instructed the students to describe the strategies they used to learn the information needed to answer each question. The second posttest was the paired-associate learning task used in the previous study.

Design and Procedure. The students were randomly assigned to one of three groups: training with experimenter-guided practice (N = 24), training with non-guided practice (N = 22), and control (N = 17). They met in groups of five to twelve for one 2-hour session. For the two training groups, the session included instructions with demonstration exercises similar to the basic processes training in the two previous studies (see Appendix B) except that only one exercise was included for each strategy, then practice, and posttesting. The control group received no instruction in the use of cognitive learning strategies, but did perform the exercises, read the practice materials, and complete the posttest.

After completion of this training phase, the practice packets were distributed. The students were given 5 minutes to read and formulate learning strategies for the first reading. They were then told to turn the page and were given 2 minutes to answer the first post-question and to describe the strategy they had used to help them remember the relevant information. For the group which received experimenter-guided practice, several examples of student-generated strategies, as well as how these examples incorporated one or more of the characteristics presented earlier, were discussed. If a student-generated example did not incorporate any characteristics of an effective strategy, the experimenter demonstrated how the strategy might be made more effective. Next the correct answer to the question was reviewed.

Following this discussion, the students listened to two or three experimenter-provided examples of strategies and explanations of how they were formulated. In addition, it was emphasized that there are many possible learning strategies that may be generated for learning the same information, and that students should use the strategy or combination of strategies that works best for them. The students were then told to work on the next question for 2 minutes. This was followed by a similar discussion of student-generated and experimenter-provided examples. This same procedure was repeated for both of the remaining practice passages. The administration of the posttests completed the session.

Students in the non-guided practice group received the practice packets and were given the same time limits for reading the passages and answering the questions, but they did not discuss student-generated strategies, nor were they provided with examples of strategies.

Students in the control group were given general directions for each of the training exercises but did not receive any instructions pertaining to the strategies; i.e., in contrast to the instructions given to the training groups, the control group was only asked to describe a picture of two people on a picnic. The students in the control group also read the practice passages and answered the questions; they were not requested to describe their learning strategies.

The posttest tasks were administered to all groups during the last part of the session. Students were allowed 15 minutes to study the passage about the Earth's gradational agents. They then had 10 minutes to complete the 6-item comprehension test and to describe the strategies they used to learn the information needed to answer each question. The students in the control group did not have previous experience in describing their learning strategies, so they were asked to describe any special learning methods or techniques that

they used to help them learn the material covered by each of the questions in the test booklet.

The second posttest was a paired-associate task. Using the study-test method, the 28 word-pair list was presented at an 8-second exposure rate for both the study and test segments.

Results and Discussion

One-way analyses of variance were performed on the data from each of the posttest tasks. One student in the group that received training with experimenter-guided practice did not complete the reading comprehension test and was eliminated from that analysis. The adjusted number of students in the three groups, as well as the means and standard deviations for both of the posttest tasks, can be found in Table 9.

The results of the one-way analysis of variance for the data from the reading comprehension task (see Table 10) revealed a significant difference among the group means, ($F(2, 59) = 3.29$, $p < .05$). A Newman-Keuls analysis revealed that the performance of the training group with non-guided practice surpassed the performance of the control group. The performance of the training group that received experimenter-guided practice was between that of the other two groups and not significantly different from either.

The results of the one-way analysis of variance for the data from the paired-associate task (see Table 11) also revealed a significant difference among the group means, ($F(2, 60) = 4.88$, $p < .05$). A Newman-Keuls procedure revealed that the performance of both groups trained to use learning strategies significantly surpassed the performance of the control group. There was, however, no significant difference between the group that received experimenter-guided practice and the group that received non-guided practice.

These results demonstrate the effectiveness of a cognitive learning strategies training program that teaches the basic processes underlying the

TABLE 9

Means and Standard Deviations for
the Posttest Tasks in Experiment III

| Dependent Measure | Group | N | Mean | S.D. |
|---|---|---|---|---|
| Reading Comprehension | Experimenter-guided practice | 23 | 7.02 | 3.23 |
| (Gradational Agents) | Non-guided practice | 22 | 7.59 | 2.99 |
| (maximum score = 15) | Control | 17 | 5.06 | 2.99 |
| Paired-Associate Task | Experimenter-guided practice | 24 | 10.17 | 6.69 |
| (maximum score = 28) | Non-guided practice | 22 | 9.73 | 5.99 |
| | Control | 17 | 4.71 | 5.48 |

TABLE 10

Source Table for Analysis of Variance on the Reading Comprehension Test in Experiment III

| Source | SS | df | MS | F | p |
|---|---|---|---|---|---|
| Between Groups | 65.62 | 2 | 32.81 | 3.29 | <.05 |
| Within Groups | 588.00 | 59 | 9.97 | | |
| Total | 653.62 | 61 | | | |

TABLE 11

Source Table for Analysis of Variance on the Paired-Associate Task in Experiment III

| Source | SS | df | MS | F | p |
|---|---|---|---|---|---|
| Between Groups | 344.42 | 2 | 172.21 | 4.88 | <.05 |
| Within Groups | 2119.23 | 60 | 35.32 | | |
| Total | 2463.65 | 62 | | | |

formulation of such strategies. However, the results obtained for experimenter-guided versus non-guided practice were somewhat surprising. The group that received training with non-guided practice performed above the control group on both posttests. The group that was trained with the experimenter-guided practice only surpassed the control group on the paired-associate test, not on the reading comprehension test. Since the practice involved reading comprehension tasks only, it may be that the provision of experimenter-guided practice imposed restrictions on the strategies that the students generated for the subsequent reading comprehension posttest. That is, the students may have limited their own strategy formulation by attempting to model either the experimenter-provided examples or the student-generated examples discussed by the experimenter. However, it is possible that when faced with a different type of posttest, such as the paired-associate task, students are capable of disregarding the models provided during the practice with reading comprehension tasks.

All training programs described in the two previous studies included experimenter-guided practice. It was expected that such guidance would facilitate the students' use of the strategies by providing an opportunity for feedback and discussion of students' strategies as well as broadening the students' awareness of possible strategies for a given task. However, the effect appears to be quite the opposite for posttest tasks similar to those used for practice, and may account for the inability of previous training programs to demonstrate their effectiveness on reading comprehension tasks. The structural modification of these tasks in the present study made the performance demands less ambiguous, and should, therefore, have reduced the students' reliance on models provided during experimenter-guided practice. However, further research is needed to determine if there are any differential effects of the components of experimenter-guided practice and how generalizable

these effects might be to other populations, tasks, and strategies.

## Future Directions

The research and development effort described in this report will continue as part of the Cognitive Learning Strategies Project at The University of Texas at Austin. The goals of this project are to refine our understanding of the covert processes involved in utilizing cognitive strategies for learning and retention, and to design, develop, and field test training programs to modify learners' information processing strategies. As we increase our understanding of information-processing skills that contribute to effective and efficient learning, we will be able to provide heuristic means for the individual learner to use in identifying, monitoring, modifying, and implementing a plan for achieving instructional goals.

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APPENDIX A

Instructions for the Traditional Group in the Study Comparing Three Forms of a Cognitive Learning Strategies Training Program

Hi, thank you for coming today. My name is _____. I'm interested in developing better learning methods. During the next two hours you will read about several methods that are helpful for certain kinds of learning. You will have a chance to practice these methods, or learning strategies, during the first part of the period. Then during the last part of the period I will test you to see how well you learned to use them. This is not an intelligence test. You, the student, are not being tested. Instead, we will test the effectiveness of the learning strategies that you are going to learn. Obviously, the better you learn the strategies, the more we can find out about them when we test. So, even though you may find these learning methods new, try to master them as well as you can during the practice session.

Are there any questions?

Training Instructions

Please do not open this booklet until I tell you. When I ask you to look at this booklet, study it one section at a time. You will have 8 minutes to read each section, so please take your time and try to learn these methods. You will also find that they are very helpful for your schoolwork.

If at any time you are confused about what you should be doing or need some help, just raise your hand and I will be happy to come by and assist

you. Please don't write in the Learning Strategies Instruction Packet, but do put your name on all other materials.

Are there any questions? You may begin. Stop when you finish page 3. (Students now read booklet until they have finished Imagery Section.)

Now, would someone like to give me an example of an image they came up with?

(Experimenter discusses example and gives feedback.)

Would someone else like to give an example?

(Discussion and feedback)

Now, please return to the booklet and read the next section. You will have 8 minutes.

(Students read Meaningful Elaboration Section.)

Are there any questions?

Would someone like to give an example of how they used elaboration with the reading?

(Discussion and feedback)

Does someone else have an example?

(Discussion and feedback)

Now, please return to the booklet and read the last section. You will have 8 minutes.

(Students read Grouping Section.)

Are there any questions?

Would someone like to give an example of a grouping they came up with?

(Discussion and feedback)

Does someone else have an example?

(Discussion and feedback)

Are there any questions?

Please pass the packets back to me.

Now return the papers you have written on. Be sure your name is at the top.

Here is your first practice reading. Please do not turn over the reading until I tell you. I want you to read it carefully and try to use as many of the methods and strategies that you have read about as possible. Remember, try to use imagery, meaningful elaboration and grouping. Write your strategies down on the scratch paper as you go, and I will come around to see how you are doing. Remember, this is not an intelligence test. You are helping us to learn about the effectiveness of these strategies. So work hard and carefully. Put your name on all the sheets of paper you use. Write down a brief description of your aids as you go. You will have 8 minutes to read the passage and use the strategies.

Are there any questions?

Go ahead - Begin.

Please stop and return the reading. Now please return the papers you have written on. Be sure your name is at the top.

Here is another practice reading. Read it carefully and try to use as many of the methods and strategies that we have been discussing as possible. You will have 8 minutes for this reading.

Are there any questions?

Begin reading.

Please stop and return the reading. Now please return the papers you have written on. Be sure your name is at the top.

Testing Instructions

You will now be given a reading to see how well you have learned and can use the strategies. Please do not turn this reading over until I tell you to begin. Read it carefully, and use as many of your strategies as possible to learn the content. Remember to use imagery, meaningful elaboration, and grouping. Use as many of the strategies as possible. Use these strategies in your mind only. Do not take notes or mark on the reading. After you have been given time to read the passage and use the strategies, I will collect the readings and give you some questions to answer about what you have read. You will have 8 minutes to read this passage. Are there any questions?

You may begin reading.

Please stop reading and return the materials.

Here are some questions about the passage. Please do not turn them over until I tell you. As you work through the questions, recall your strategies to help you answer the questions. You will have 8 minutes to answer the questions. Please write neatly, and put your name at the top of the page.

Stop working on the questions now, and please hand in your answer sheets. Make sure your name is on the sheet.

That's about it for today. Thanks for coming.

APPENDIX B

Instructions for the Basic Processes Group
in the Study Comparing Three Forms of a
Cognitive Learning Strategies Training Program

Hi, thank you for coming today. My name is _____.

This study is concerned with how people learn and how they might learn better and more efficiently. We are going to take some time to explain, illustrate, and then practice a number of techniques or strategies that have proven helpful to other students in learning new material. Then, during the last part of the period, I will test you to see how well you learned to use them. This is not an intelligence test. You, the student, are not being tested. Instead, we will test the effectiveness of the learning strategies that you are going to learn. Obviously, the better you learn the strategies, the more we can find out about them when we test. So, even though you may find these learning methods new, try to master them as well as you can during the practice session.

Through other studies related to this one, three particular strategies have been identified and developed to increase a person's ability to learn. The three techniques are called mental imagery, elaboration, and grouping.

Training Instructions

The first strategy we will practice is called imagery. Essentially, this technique involves forming a mental picture of the thing you want to learn. I want you to practice forming visual images or mental pictures

which are really memorable so you can remember them and use them to learn other things later. To help make your image memorable, work on making it as clear and detailed as possible, make it as visual and striking as possible, and try to give it personal meaning for you.

Okay, let's try it. Relax and picture two people having a picnic. You will now have about 5 minutes to practice. Try to really see your mental image of the two people having a picnic and then write down a description of what you see.

(Wait 3 - 5 minutes.)

Now compare and contrast your description of this picnic with our general outline of what a useful, memorable image is. First, did you make it sharp and clear by including a lot of detail?

What was the body build of the two people in your image?

What were they wearing?

What were they doing?

What kind of emotion were they expressing?

Did you picture anything in color?

Is the grass around the picnic green or all dried up?

What other surrounding terrain is there?

Is the sky clear or cloudy?

What about the weather?

You see the point, there are a lot of details that can be fleshed out to make your image clear and more like a photograph. Work on achieving that clarity to make it more memorable. Would someone like to tell us about their image?

Next, how about vividness? Did you make your image striking:

--by making one or both of the people unusual in appearance; very large, very mean looking, etc.

--by making it very active. Imagine, for example, that the two people are chasing each other around the picnic table.

--using unusual colors. Maybe the two people are eating purple fried chicken.

--use unusual settings. Perhaps the picnic is on top of the Leaning Tower of Pisa and the food keeps sliding off the table.

These are, of course, only a few of the things you could do to make your image interesting or vivid.

Finally, did you do something to make it personally memorable for you?

--Did you imagine a picnic you were on recently?

--Did you see people that you know at the picnic?

--If you are especially interested in music, were the two people playing guitars and singing?

The idea here is to fit your image into your own personal experience, to relate it to your prior knowledge and your interests. Would someone else tell us about their image?

Now let's try another example. Relax and try to form a mental image of a person fishing. Take about 5 minutes to work on your image and then write down what you see. Now let's check your description against the points discussed above. Will someone tell me about the details they used to make their image clear?

Okay, now what did you do to make it vivid and striking?

Fine, now what kinds of things did you do to make it personally relevant?

Now we are going to have one last imaging task. Relax and imagine the house of your dreams.

Now write down a description of that house, keeping in mind that you are talking to an architect who's going to build a house for you according to the description. Be sure to recall everything that has been discussed about good mental images:

clear and detailed

visual and striking

personal meaning

You have about 5 minutes.

The second strategy we are going to discuss is called grouping. If you have a long list of things you have to learn, it is often very useful to group them into several subcategories to make it easier to learn the list. A few good tips are: you should use an optimum number of groups (something between two and eight may be ideal), your grouping should be based on salient and memorable features, your methods of grouping should be as systematic and simple as possible, and your groups should have personal meaning for you.

For example, suppose you had a list of all the current makes of automobiles and you wanted to learn it. Take a minute to think of different ways you might classify the cars. One way you could classify the cars would be by size--la ge, medium, compact, and subcompact. If you classified them by pounds of weight it wouldn't be very helpful because there

would be too many groups, and if you classified them by number of wheels you would have too few groups.

Second, try to use highly salient or memorable features--size, country of origin, general price range--these are things we all know about and can remember. If you classify cars by the kinds of alloys used in making their engines you are not likely to be helped by your grouping because you will not remember it (unless you are really an expert in the field).

Third, keep your method of grouping simple and systematic. If you classify cars by the ratio of head space to cost or put together cars which just seem to go together, you will again probably find it very difficult to recapture your original grouping.

Finally, it will probably help to let your grouping be based on what is important to you. Thus, if you are very concerned about the energy crisis, you might want to classify cars by their fuel economy or if you are mechanically minded, by engine type.

Now let's try another example. Take about 5 minutes to think of as many useful ways as you can for grouping the states of the United States to help you learn them.

(Wait 3-5 minutes.)

Now let's check your grouping against the points discussed above. Will someone illustrate how they divided the states to get an optimum number of categories?

Okay, what salient or memorable attributes of the states did you use in your grouping?

Who has a good example of a simple and systematic way of grouping the

states?

Who used a grouping which had special meaning for them?

The third and final strategy that we are going to discuss is called meaningful elaboration. This strategy involves the attempt to make a piece of information more meaningful by adding to it. This can be done by: (1) relating the information, when appropriate, to your personal experiences, your beliefs, your attitudes, to what you already know; (2) finding logical relationships between portions of the material; (3) thinking of implications of the information; (4) contrasting and comparing parts of the material; and (5) inventing stories or sentences which relate parts of the material to other parts.

Here is an often quoted sentence from Rousseau, "Man is born free and everywhere he is in chains." We are going to try to understand and remember this quotation by using the strategy of meaningful elaboration.

To begin with, write down what you think this sentence means, and elaborate on it in as many ways as you can. You will have 5 minutes.

(Wait 3-5 minutes.)

Now compare and contrast your elaboration against the following outline.

Did you relate any part of the sentence to your own personal experiences? To your beliefs? To your attitudes? Maybe you have been feeling chained by rules and regulations, or feel that the statement really speaks to your condition. Or maybe you feel just the opposite.

Did you relate any part of the sentence to something you already know? You may have already known, for example, that Rousseau was a French

philosopher who had a great influence on the progressive education movement. You might have thought that it is not surprising that someone who argued for progressive education would be very concerned with the issue of personal freedom.

Did you find any logical relationships between portions of the material? You may have thought that at first glance the two parts of the sentence appear to be logically inconsistent, but that on more careful inspection, they are not.

Did you compare and contrast any of the notions implied by, or contained in this sentence? You might notice, for example, that a lot of the impact of this sentence comes from the strong contrast it contains. You might also want to think about the similarities and the differences in the meaning of the word "free" as it applies to newborn babies on the one hand and to adults on the other hand. Or you might notice the stylistic contrast in the two parts of the sentence. In the first part the concept of freedom is expressed directly; in the second part it is expressed metaphorically.

Did you invent a story or sentence which related parts of the sentence with any other parts? You might make up a story about a world in which people are born out in the wild but then are sent to the cities where everything, including clothing, is made of chains.

Did you think of possible implications of the sentence? You might think that if this statement is true, we'd all be better off if we were still uncivilized, or that any attempt to build a Utopian society is headed in exactly the wrong direction.

With this added information, let's look at a more light-hearted example,

"A fool and his money are soon parted." Write down what comes to your mind concerning this truism. Remember the discussion of useful elaboration procedures. Make it as meaningful for yourself as possible. You will have 5 minutes. Remember to check your description against the points discussed above.

Now, take a minute to see if you can remember the characteristics needed to effectively use (1) imagery, (2) grouping, and (3) meaningful elaboration.

Imagery

1. clear & detailed
2. vivid & striking
3. personally meaningful

Grouping

1. optimum number of groups
2. salient & memorable features
3. systematic & simple
4. personally meaningful

Elaboration

1. relate to your personal experience, beliefs, attitudes, knowledge
2. find logical relationships
3. think about implications
4. compare & contrast parts of the material
5. invent stories or sentences which relate parts of the material to other parts

Now please return the papers you have written on--be sure your name is

at the top.

You will now be given a reading to see how well you have learned and can use the strategies. Please do not turn this reading over until I tell you to begin. Then, read it carefully, and use as many of your strategies as possible to learn the content. Remember to use imagery, meaningful elaboration, and grouping. Use as many of the strategies as possible, but some of the strategies may be more appropriate than others, and some may work easier for you than others. Use these strategies in your mind only. Do not take notes or mark on the reading. After you have been given time to read the passage and use the strategies, I will collect the readings and give you some questions to answer about what you have read. You will have 8 minutes to read this passage.

Are there any questions?

You may begin reading.

Please stop reading and return the materials.

Here are some questions about the passage. Please do not turn them over until I tell you. As you work through the questions, recall your strategies to help you answer the questions. Please write neatly, and put your name at the top of the page.

Stop working on the questions now, and please hand in your answer sheets. Make sure your name is on the sheet.

That's about it for today. Thanks for coming.

APPENDIX C

Student Packet for the Traditional Group in the Study Comparing Three Forms of a Cognitive Learning Strategies Training Program

Sample Passage

Like Marcel, I believe that, in its present form, the school should be abolished. I would preserve a few of the facilities of the school -- the library, the assembly hall, the gymnasium, the playing field -- but as facilities only. Young people could use these for studying and for group activities, such as games, playacting, and musical performances. Instead of going to school for an education, the young person would go to a teacher. Student and teacher would meet in the teacher's home, or in the student's, or, if appropriate, on location. Sometimes the student would come alone, and sometimes with friends. I believe that under this arrangement the student would accomplish much more and in much shorter time than he does now. For the teacher would meet the student where he individually is.

I realize that this is a highly radical proposal and will be called impractical. But today's public schools are little more than a hundred years old and when first conceived, were also called radical and impractical. I cannot help recalling the kind of school that J. D. Salinger's Teddy wanted. He would first "assemble" the students and "show them how to meditate." He would "try to show them how to find out who they are, not just what their names are and things like that.... He would even try to "get them to empty out their heads" of all the stuff their parents and others had told

them. If, as Camus said, "There is a whole civilization to be remade," Teddy's school would be an ideal way to start remaking it. As I have said before, teachers alone cannot rebuild a civilization. But they can do much to educate individual pupils who may one day set about doing so.

George Kneller, Foundations of Education, 1971, p. 264.

## Instructions for Imagery

(Please refer to the Sample Passage)

The strategy using imagery calls for forming a picture in your head of the person and events you read about in a passage. For example, if you read a story about a boy named Joe who went to France, you might picture Joe Namath atop the Eiffel Tower. This is what is meant by imagery. We are going to concentrate on using images to learn the material in the sample passage. For example, "...in its present form, the school should be abolished. I would preserve a few of the facilities of the school--the library, the assembly hall, the gymnasium, the playing field--but as facilities only." This thought could be expressed using two connected images.

First, imagine the abolishment of a school physically. Picture your old high school and visualize a huge ball and crane smashing down its walls. The second part of the quotation could be imagined by calling parts of your high school building back into existence, much like a motion picture running backwards. Once the school is back together think of it as being there without any people in it.

Another example is to picture a group of young people playing basketball in the gymnasium, or football on the playing field.

A fourth image might be to picture a boy named Teddy assembling a group of students on the football field and teaching them to sit cross-legged and meditate.

Additionally, you might imagine a picture of students, going in groups to an assembly hall to listen to a speech by J. D. Salinger. Afterwards, they run to the gym and the playing field where some students sit and meditate on Camus.

In another image you might see a group of radical students outside the assembly hall protesting archaic educational methods and threatening to abolish the schools.

Or you might picture a large empty gymnasium with one teacher and one student sitting in the middle of the floor discussing the rebuilding of civilization. The next day you see them as brick masons actually building this new civilization.

A further image might be of a big teddy bear with J. D. Salinger written across its front going around shaking all the worthless stuff out of students' heads.

Take a few moments and try to do what we have just done with another part of the sample passage. Try to think of several examples, and make notes about them on the extra paper provided.

When you are through we will discuss a few of your examples.

## Instructions for Grouping

(Please refer to the Sample Passage)

The strategy using grouping is actually a combination of a couple of strategies. This time you will look at a part of the sample passage and group information. Then you could use imagery or form a sentence to make the grouping more meaningful.

As you read something, certain ideas, facts, and names may occur. As they appear in a passage it is helpful to be able to place these ideas, facts, or names into some category. This enables you to learn by joining together what were before loose facts. You could then generate a mental image or sentence using all the members of this group. For example, in this passage four names are mentioned, Marcel, J. D. Salinger, Teddy, and Camus. You could invent a category called "people in the passage" or some similar title to give you some handle on this portion of the reading. Examples of a sentence or phrase using these four names might be, "Camus sounds like canoe, M[illegible]l sounds like 'oh-well,' Oh well, J. D. and Teddy are riding in the canoe." Even more meaning could be added by imagining a teddy bear, a juvenile delinquent, and poor Marcel, actually riding in a canoe. This same approach of categorizing things and elaborating on them as you go can be applied to any part of the passage, as long as the grouping makes sense to you. It may not be meaningful to anyone but you. If the group makes sense to you, it will help you learn the passage.

Take a few moments and apply this strategy to some ideas or facts that are in the sample passage. The important thing is to make things more mean-

ingful to you. Please make notes about the examples or ideas you come up with. When you are through we will discuss a few of your examples.

Instructions for Meaningful Elaboration

(Please refer to the Sample Passage)

The strategy using elaboration has to do with making what you have read more meaningful through a process in which you ask and answer certain types of questions. As you read through a passage, you could ask and answer questions in which you actively process the information. Such questions might be: "What is the purpose of this material?" or "How does this relate to my experiences, beliefs, attitudes, and knowledge?" or "How would most people react to this?" or "What are the implications of what is being said, if it were actually done?" or "What are the logical relationships in the material? Does it make good, common sense?" There are other questions that can be asked and answered. These give you some idea of what to look for and what to do.

In the sample passage you could ask the question "How does this relate to my experiences, beliefs, attitudes, or knowledge?" One response might be to say to yourself, "The guy who wrote this must have been reading my mind. He knows exactly how I feel about our system of public education and the kind of experiences I had in school. As it is now, people don't learn much of anything!" Or I might say to myself, "Wow! The person who wrote this must be some kind of radical nut. Doesn't he know the 60's are over? Our schools aren't perfect, but they're still the best in the world. I remember some good learning experiences I could not have gotten with Kneller's (the author

of the sample passage) approach."

You could also try to draw logical inferences as you read; for example, you could ask the question, "If everybody felt the way Kneller feels about schools, what kind of a country would this be? How might young people be different if they did not have to go to school as much as they do now?" Then, your reply to the question you just asked might be, "This would be a very different type of country if our system of education were changed as radically as Kneller suggests. Young people would either learn to manage their time and activities effectively or they might turn to a very wasteful approach to spending their day."

These are examples of asking and answering questions about things you read. This will help to make it more personally meaningful to you. The more of these types of questions you can think about and answer, the more able you will be to remember and use the information, thoughts, or ideas you are trying to learn.

Another way to elaborate the material would be to think about the purpose or need for the material. You might ask such questions as, "What is wrong with our educational system that would cause anyone to criticize it?" Or you could relate it to your own characteristics by asking questions such as, "Would I be able to learn in a school system such as Kneller proposes?" Further, you could ask if other people, in general, would also benefit from such a system, or would such a system even work in a society like ours. How would other people react to this passage? Would they agree with it, or be shocked by its ideas? These are further questions you might ask yourself to help you understand or remember the material better.

One other way you might elaborate upon this material would be to look for common sense or logical relationships in the material. Some passages form concrete, logical relationships naturally, whereas other passages lend themselves more to abstract, logical relationships. For example, if the school in its present form were abolished, then it would be logical to assume some alternative form would exist such as the one suggested by J. D. Salinger's Teddy.

Take a few moments and use one of the suggested questions, or one of your own, and apply it to the sample passage. Please make notes about the ideas or examples you come up with. When you are through we will discuss a few of your examples.

1 AIR FORCE HUMAN RESOURCES LAB ATTN: AFHRL/TSR
1 NAVY PERSONNEL R AND D CENTER /
1 OFC OF NAVAL RESEARCH PROJECT OFFICER, ENVIRONMENTAL PHYSIOLOGY
1 NAVAL AEROSPACE MEDICAL RSCH LAB AIRBORNE RANGER RESEARCH
1 USA RESEARCH AND TECHNOLOGY LAB ATTN: DAVDL-AS (DR. R. S. DUNN)
1 NAFEC HUMAN ENGINEERING BRANCH
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